The rhythm used is that of a movement of the forearm. A series of movements is made in a natural rhythm, then other series in unnatural rhythms. The average and the mean variation (mean error) are computed for each series. The psychological mean variation (all apparatus errors being rendered negligible) is a good measure of the subject's irregularity or of the difficulty of his mental processes. Using the mean variation thus as a measure of the disadvantage of a rhythm, we can express the relation of disadvantage to length as $m = f(r)$ where m is the mean variation and r the length of the rhythm. Now, the law that I believe myself able to assert is

$$\frac{m}{\text{abs }(r-R)} = \text{const.}$$

where m and r have the same meanings as before, R is the length of the natural rhythm and abs indicates that the sign of the quantity is disregarded. In other words, the amount of irregularity is proportional to the amount of deviation from the natural rhythm.

The full proof of the law with a determination of the constants I hope to furnish during the coming year. E. W. SCRIPTURE.

YALE UNIVERSITY, September 20, 1896.

SCIENTIFIC LITERATURE.

The American Lobster: A Study of Its Habits and Development. By FRANCIS HOBART HERRICK.

This monograph, issued as a portion of the Bulletin of the U. S. Fish Commission for 1895, has over 250 pages of text and 64 plates, and represents the work of the author as an investigator of the U. S. Fish Commission from 1890 to 1895. Its general appearance is quite up to the improved standard of the more recent government publications. The typography is good and many of the plates are really excellent.

It is presumed that the publications of the Fish Commission will have some practical bearing upon the innumerable problems of fish-culture, and Dr. Herrick has not confined himself to mere questions of morphology and embryology, but, following the suggestion of Prof. Rathbun, has endeavored to determine the *natural history* of this most important and strangely persecuted invertebrate; and it is to be hoped that with these natural data at hand the government will adopt some rational method of experimentation which shall finally lead to successful lobster culture.

In the Introduction the author considers the immediate questions of nomenclature, the methods of lobster capture, and the rise and inexcusable decline of the lobster fishery in America.

Chapter II. deals at considerable length with the general subject of reproduction. The essential and secondary organs are described, the peculiar pairing habits of certain Crustacea are mentioned, and the methods of oviposition are discussed. In describing the spermatozoa the author writes: "The sperm cells have a characteristic shape and are absolutely immobile in the conditions under which they are ordinarily observed, but it is impossible to suppose that this is always the case." The reviewer has seen the spermatozoa in active movement, swimming across the field of the microscope with the same nervous contractions that are characteristic of the Hydromedusæ.

The facts collected in reference to the time of egg-laying and period of incubation are very complete, and indicate the time when artificial hatching should commence. We cannot, however, agree with the author that there are at present adequate data for the assumption that eggs are frequently deposited during the fall and winter. When the temperature of the water is known to be so important a factor in the rate of development, and when the range of temperature variation is from 35.5° F. in February to 71.4° F. in August, it is extremely hazardous to estimate the actual age of 'winter' embryos from the known age of those whose growth has been accelerated by the warmer water of midsummer.

The data illustrating the law of production, arranged in Table XV., have been gathered from an examination of 4,000 adult lobsters, and represent a vast amount of work. The rearrangement of this material in other tables, and the author's conclusions regarding the period of greatest fertility, are especially instructive.

In dealing with the destruction of the egg-lobster and its spawn, it is to be regretted that

Dr. Herrick has not expressed disapproval of the destructive methods of 'lobster-hatching' that have been practiced in certain hatcheries for several seasons past.

The subject of molting and the function of the gastroliths are exhaustively treated, the literature reviewed, erroneous ideas corrected, and many interesting observations recorded.

In Chapter IV., on the Regeneration of Lost Parts, we read, "the new limb appears to arise mainly by growth of the connective-tissue cells already present in the stump;" and, further on, "the fibrous tissue becomes gradually differentiated into the muscles, blood-vessels and nerves, as in an embryo." It is unfortunate that figures are not given illustrating this method of regeneration. The sections on Variation will supply valuable material for one interested in the lines of investigation outlined by Bateson.

Chapters XI.–XIII. deal with general questions of crustacean development and larval life, and are excellently illustrated by prints and colored plates.

We may add in conclusion that, from the breadth of the field covered, Dr. Herrick's paper will be frequently consulted, not only by those devoted to artificial fish-culture, but by working naturalists, whether embryologists, physiologists or students of variation.

H. C. BUMPUS.

BROWN UNIVERSITY.

ISOPENTANE AND HEXANE.

The Thermal Properties of Isopentane. By SYDNEY YOUNG, D. SC., F. R. S., University College, Bristol. (Communicated to the Physical Society of London.)

The isopentane employed in this research was procured from Kahlbaum, of Berlin; the substance is obtained as a bye-product in the manufacture of amylene from amyl alcohol by the action of zinc chloride. The isopentane was purified by repeated agitation with concentrated sulphuric acid and with a mixture of sulphuric and nitric acids and by subsequent fractional distillation.

The vapor pressures were determined at temperatures from —30° to the critical point, 187.8°; the orthobaric volumes of a gram of liquid from 0° and of saturated vapor from 10° to the critical point; and the volumes of liquid and of unsaturated vapor between wide limits of temperature and pressure.

The experimental methods employed are described in the original paper and, in regard to pressure, the error due to the vapor pressure of mercury is fully discussed. The volumes of a gram of liquid and vapor were plotted against the pressure and from the isothermals isochors were constructed; it was found that at large volumes and just about the critical volume the isochors were straight, at any rate within the limits of experimental error, but that at volumes smaller than the critical volume the values of $\frac{dp}{dt}$ increased slightly with rise of temperature, whilst at volumes greater than the critical volume they diminished slightly with rise of temperature.

The formula $p=bT—a$ at constant volume (Ramsay & Young, Phil. Mag., 1887, 435, *cf.* Amagat, Compt. Rend., 94, 847), is therefore not quite, though very nearly, true for isopentane, and the results seem to confirm the conclusion arrived at by Amagat in the case of the substances examined by him that the values of b are not absolutely constant.

Values of b and $\frac{10{,}000}{bv}$ and of a and $\frac{10^{10}}{av^2}$ for volumes of a gram from 1.58 to 4000 cub. cms. are given in the original paper.

The absolute temperatures (boiling points) and molecular volumes of liquid and saturated vapor were read from the curves at pressures 'corresponding' to those adopted in previous papers on the 'Generalizations of Van der Waals regarding Corresponding Temperatures, Pressures and Volumes,' (Phil. Mag., Feb., 1892, 153; Jan., 1894, 1; Trans. Chem. Soc., 63, 1191) and the ratios of the temperatures and volumes to the critical constants were calculated. The ratios prove that isopentane belongs to Group I in the classification of substances previously adopted (Phil. Mag., Jan., 1894, 1).

The ratio of the actual to the theoretical density at the critical point, 3.73, agrees well with the ratios for the other members of Group I (3.65 to 3.83), and with that for carbon dioxide (3.62) deduced from Amagat's observations.